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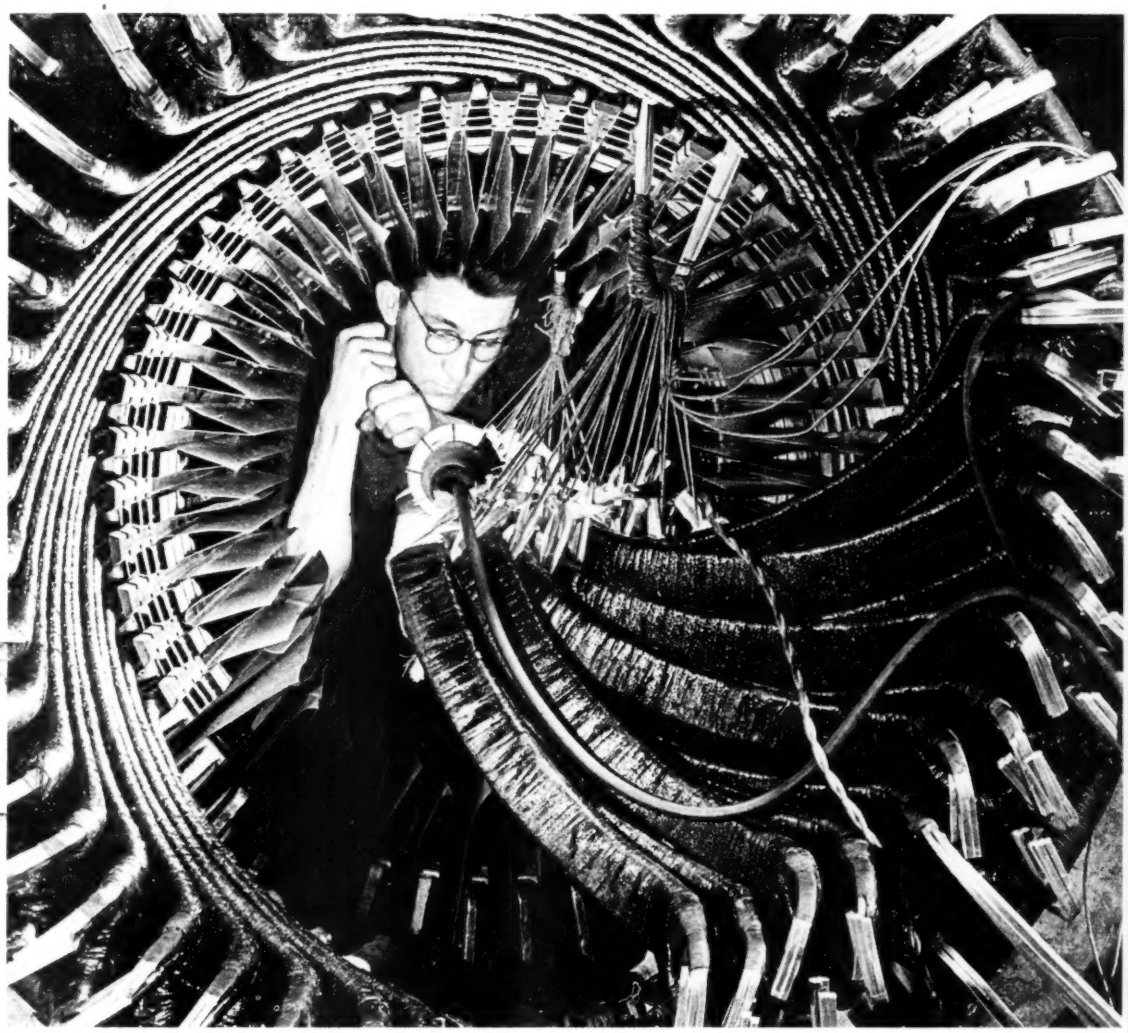

WESTERN SOCIETY OF ENGINEERS FOUNDED 1869

SPLITTING THE INCH — PAGE THREE

Vol. 7 AUGUST, 1954 No. 3

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Midwest Engineer

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WESTERN SOCIETY OF ENGINEERS

Serving the Engineering Profession

AUGUST, 1954 Vol. 7, No. 3

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COVER STORY

Caught in a whirlpool—man needs help? No, he's just inserting the tape-wound copper stator coils in which electricity will be generated when the rotor of this turbine generator whizzes and whirls past them at a speed of 235 miles per hour.

—WESTINGHOUSE PHOTO

Your Pet Project MAY BECOME A PRIZE PAPER

Jot down the ideas you've had for a long time . . .

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Here are the rules:

Any member of the Society may compete regardless of grade of membership.

Papers shall not be highly technical in nature. A clear, concise and interesting coverage is desired rather than complex formulae or derivations. The subject discussed should be of general interest to engineers but should not be of a political or highly controversial nature.

All members of the Society who wish to submit papers in this contest should contact the Secretary as early as possible and not later than February 1, 1955, and request a copy of the rules governing the competition and an outline of the minimum requirements for acceptance of papers. These cover in detail the mechanical make-up which should be followed in preparing and submitting papers for the contest.

Papers must be submitted to the Secretary for acceptance by April 1, 1955. If the Secretary finds that they meet the minimum requirements of the contest, he will forward them to the Awards Committee for review. The papers will be identified by number only. The Secretary of the Society is the only person who will maintain the key to the authors.

If any paper does not comply with such minimum requirements, the Secretary will so advise the author and discuss with him the points which are below the minimum requirements. The papers which are accepted will be forwarded to the Awards Committee for judging not later than May 1, 1955. Papers which have not met the minimum requirements by that time cannot be considered for prizes.

Papers which are accepted will be judged on originality of presentation, editorial merit and value to the engineering profession.

The papers submitted must not have been previously published in substantially the same form. No copyrighted materials shall be used unless permission has been obtained and so indicated. All manuscripts, drawings, etc., are to become the property of the Society and cannot be published without the consent of the Society.

If the papers submitted are NOT of sufficient merit to warrant the award of any or all of the prizes, the Awards Committee reserves the right to award less than the five established prizes or to postpone the competition.

The winners will be announced and the prizes presented at the annual meeting of the Society in June, 1955.

WSE Executive Secretary will furnish you with a complete set of rules and minimum requirements on request.

It Has Paced Man's Progress

Splitting the Inch

By Louis Polk

If asked to name the world's most important and useful discovery, there would be serious competition for this honor from many worthy contenders—the use of fire, invention of the wheel, the alphabet, printing, steam power, harnessing of electricity and atomic energy. However, still another that would have to be considered, and respectfully it's my choice—some primitive man's basic idea ages ago, who in a sense founded engineering when he *learned to measure*. He discovered the basic key to the progress that has made possible today's civilization. Abolish measurement and there would be chaos.

And so with full recognition and acknowledgement of the basic and fundamental importance of tools and machine tools—the machines that make the machines—let's look further at another member of the production team without which there would be no modern manufacture nor modern machine tools. Let's look at measurement.

Lord Kelvin said: ". . . that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind. It may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be."

There is little doubt that man measured the things he made long before the dawn of recorded history. The Pyramids dating back to 4700 BC, the Tower of Babel, and boats at the time of the Biblical Ark were built by some definite system of measurement. The progress of measurement for the next few thousand years is obscure, but variability was the rule. Prior to the industrial era, a craftsman made a product in its entirety, measuring and fitting each element as he went along. Then an oft-mentioned American inventor, Eli Whitney, designed and built machinery and tools to produce muskets on a mass production basis, doubtless using selected gun parts and other means as patterns or gages to establish his standards of uniform measurement. While not one of his companies survived him, Whitney deserves all-time recognition as the founder of interchangeable manufacture in the United States.

One of my favorite phrases is that man's progress has been paced by his increasing ability to divide the inch finer and finer. The worn shilling—that early feeler gage that James Watt couldn't insert between the bore and piston of his steam engine—shows that this division of the inch was well under way in 1798. By contrast, today industry requires in many cases precision of an extraordinary degree—for example, five millionths on some fuel injection parts in mass production. And, while mentioning millionths and split millionths, your speaker will always have a healthy respect for a true ten-thousandth of an inch. And I have little patience with those who advocate unnecessary close tolerances. Let's make and gage our products to five or twenty-five thousandths if that is satisfactory.

Production gaging in the United States really secured its toe-hold during World War I. At the end of that war, fixed gages came into wider use and these useful tools of measurement will always have an important place in production and inspection gaging. They also paved the way for instruments which were considered laboratory devices, used mainly in final inspection by highly skilled and experienced operators. These instruments were vital in the foundation of the modern interchangeable parts system.

And, happily, about that time men of great practical vision recognized the economic possibilities of the assembly line. Mass production of products increased rapidly, new and improved types of gages and measuring instruments were developed to keep abreast of the growing demands. Fortunately, several years before World War II, the American gage and precision instrument industry gained world leadership on many important types of instruments. The industry, while the last to claim perfection, has with few exceptions conducted itself with scrupulous regard for accurate claims of product performance and has shown foresight, ingenuity and constructive determination in staying out in front internationally.

You and I know that to the layman there is usually little understandable connection between high-flying jets, guided missiles, fine performing automobiles and convenient appliances as against the tools, machine tools and precision measuring instruments which importantly help make them possible. Freely and gratefully acknowledging the contributions of science and engineering to progress in all fields, it is gages and measuring instruments that control dimensional uniformity, which in turn results in interchangeable parts. These actually make possible the assembly line and relatively economical mass production. Thus I was asked to discuss that without gages and measuring instruments today's benefits of mass production would be impossible.

Mr. Polk, president of The Sheffield Corporation, Dayton, Ohio, presented this talk before the Symposium on Tools of the Centennial of Engineering in Chicago on September 5, 1952. The talk, most of which is reprinted here, is used by permission of the Centennial of Engineering, the collected talks of which are available in bound form from the Museum of Science and Industry, Chicago.

This important key to our nation's progress was well highlighted by Boss Kettering, a Dayton friend and neighbor. He said, "The only thing that makes the assembly line possible is our ability to make pieces so exactly alike that we can take any one of a thousand and drop it into place and have it fit . . . I can remember the time when a thousandth of an inch was a very small thing—now you are talking of millionths of an inch. . . .Why are you constantly working to closer limits of tolerance? Only so that the product made on machine tools shall last longer, work better and give you complete interchangeability of parts."

Just what is meant by gages, precision measuring instruments? Generally speaking, they are used to control and determine the dimensional fitness of a piece to function alone or in an assembly of which it becomes a part, to sort out and classify suitable from unsuitable parts and to check other gaging instruments. The design of measuring instruments has benefited greatly from the past, supplemented by the continuing help of engineers, production men, other industrial executives, members of the gage industry, the assistance of trade and standards associations and technical societies and committees, the Services, the National Bureau of Standards, and others.

With this broad industrial comprehension of their value, gages and measuring instruments have developed a place in our production economy the importance of which understandably is not realized by the average American . . . for measuring instruments have become management's mechanical supervisors that constantly protect management's established standards in the plant. They are the representatives of engineering, purchasing and manufacturing at inspection and production. And thus in a sense they are management itself. When they reject material that could be used, management accepts the responsibility of determining the degree of perfection desired. As management, we naturally desire the establishment of the widest possible tolerances consistent with desired performance and the practical problems of producing interchangeable parts. Gages and measuring instruments can be made to reflect whatever practical tolerances are approved.

Now, why do gages deserve to be management's representatives?

Safety becomes number one in importance, whether we think in terms of aircraft, atomic energy devices, guided missiles, tractors, automobiles, etc., to say nothing of a long list of household appliances.

Next is cost reduction. Gages eliminate or reduce scrap, salvage and rework costs, right at the machines, where the degree of quality is made or lost, or at receiving and process inspection before subsequent expensive operations are attempted. In addition, gages speed up assembly by eliminating last minute, tedious fitting. Proper gaging permits rapid selective assembly using less expensive broader manufacturing tolerances without sacrificing required final quality.

Gages help improve uniform performance with reduced servicing and maintenance. Field inventory is reduced because "field cannibalization" is possible. Proper gaging means that 99.44% of the automobiles from a particular assembly line can be driven with uniform gasoline and oil consumption for 50,000 or more trouble-free miles without a major overhaul. And similar performance is "the accepted" in thousands of other products. In aircraft, where the power-weight ratio is so important, operating weight can be reduced to an accurately controlled point without sacrificing safety. This weight saving can be converted to useful extra carrying capacity. For these and other reasons, gages justifiably represent management.

In further exploring the mass production relationship, the inspection function divides into three parts: receiving, production and final. In each case, the type of gaging should logically relate to the ultimate product requirements. Similarly, it should be determined whether all or a percentage of parts are to be checked.

(Continued on Page 11)

Employers, Ethics and Novice Engineers

By Clement J. Freund

A dean of engineering earns his living by doing a number of things. One of these things is to listen patiently and sympathetically whenever an alumnus, especially a recent graduate, feels like weeping on his shoulder.

Not long ago such a one was in my office to tell me his troubles. His troubles were really not very serious. He was two years out of college. He had a good job in one of our Detroit automobile manufacturing corporations. He was making good progress, but was restless and dissatisfied, and thought that he ought to resign and look somewhere else.

This interview was a familiar experience. It seems that very many of our engineering graduates are unhappy and discontented.

A Comparison

I could not help comparing this recent graduate with a young physician of my acquaintance who is an interne in a hospital near my home.

The young physician studied eight years following high school; the young engineer four years.

The physician has impossible working hours. He is on call day and night; the engineer works an easy forty hours per week.

The physician is married but lives at the hospital. He gets his meals there although he has an occasional day off. The engineer lives pleasantly with his wife and small son in a five room apartment.

The physician is paid $1,200 per year, and his keep; the engineer was paid $4,600 per year when he graduated, and he gets more than that now. The physician is contented with his rugged and meager assignment; the engineer is sitting on top of the world and is dissatisfied.

Obviously, the young interne has something which the engineer does not have. The engineer has an immense advantage over the interne in every respect except for that something. That something makes the young interne happy with his lot, while the engineer is clearly unhappy.

I know both young men very well. I have studied the attitudes and mode of life of each. I have just about made up my mind that I know the secret of the interne's peace of soul.

Professional Standing

The interne is a member of a great profession; he is proud of it and happy about it. The engineer may belong to a profession some day but he is not sure. Certainly he does not think much either of his profession or about it.

The interne is respected. He enjoys all the strictly professionl privileges of the oldest surgeon on the staff. He has the title of doctor, and all in the hospital address him as doctor. He has authority over nurses, attendants and other employees, many of them twice his age.

Nobody in the hospital may openly question his medical judgment except senior physicians and surgeons. Patients do not know the difference between him and the younger men on the regular medical staff.

The engineer, on the other hand, is just another employee, no different from thousands of tool-makers, assembly men, payroll clerks, draftsmen and the like. He has authority over nobody. He is a college trained engineer but, except for personnel officials, nobody knows it and nobody cares.

Significance of Ethics

What has all this to do with engineering ethics? A great deal, it seems to me. Let me start this way. Many employers are worried about the Engineers and Scientists of America. This is the union, as most of you know, which is currently attempting to enroll employed engineers. Other unions have tried, and none have achieved more than an ambitious start. But the succession of failures is small consolation to nervous engineering employers; this union might succeed.

This brings us to the core of the whole argument. In my view, employers will have no union trouble if they recognize the professional character of their engineers.

Employers, of course, do recognize technical ability and competence in engineering. But technical ability and competence are not the sum total of professional standing. Professional standing is made up of two elements: technical competence and training, and high honor and integrity, or ethics.

Engineering employers, it seems to me, ought to be as much concerned about the ethical standards of engineers as they are concerned about technical education and ability.

When I say ethical standards, I mean the ethical codes of the engineering profession. I do not mean the special policies and regulations of the particular corporation in which the engineer is employed. I make this point because employers occasionally call an employee unethical because he has merely violated some special regulation of the individual employer which pertains only to his business.

It would be interesting to gather all the seniors who were interviewed by employers this year. It would be interesting to inquire of these seniors if a

Mr. Freund gave this talk on June 15, 1954 before the Division on Relations with Industry, American Society for Engineering Education, at the University of Illinois, at Urbana, He is dean of engineering, University of Detroit.

single one of them was asked by any interviewer what he knows about the ECPD code of engineering ethics. Not a single hand will be raised in answer to your question.

When engineering employers habitually and regularly insist that engineers shall know their ethics, just as they insist that engineers shall be technically competent, they will have gone a long way toward giving engineers professional standing. Then, and not until then, will engineers enjoy the professional standing of physicians and lawyers in the employ of corporations.

Once the employer has given his engineers full professional standing, he can safely discard the countless rules and regulations of the familiar employees' handbook, as far as his engineers are concerned. If he explains to his engineers a few basic policies of his corporation, he can thereupon safely depend upon their honor and integrity as professional engineers.

Solution

The employer who does all this need not worry about the Engineers and Scientists of America, or about any other engineering union. If he will give to engineers the personal privileges that go with professional status, he will have no problem in his engineering staff, and few personnel problems of any kind.

Unions do not try to organize clearly professional people when they are known to be professional. Did you ever hear of the AFL or the CIO trying to organize the physicians of the Mayo Clinic at Rochester? Did you ever hear of an AFL or CIO union competing in Chicago with the Cook County Bar Association? Did you ever hear of the American Federation of Methodist Ministers? Did you ever hear of some radical Italian union trying to organize the staff of cardinals and monsignori at the Vatican?

No Misunderstanding

It is very easy for me to be misunderstood about an issue like this. It may be important for me to explain at this point, and to explain emphatically, that I am not opposed to labor unions in their proper function, and when they are decently and legally managed. But I am most emphatically opposed to labor unions in medicine, in law, in the ministry and in professional engineering.

Conclusion

We engineering educators must face up to our responsibilities. There are two sides to this question of engineering ethics. If General Electric, the Bell Telephone System, Westinghouse, Allis-Chalmers, and all other engineering employers begin to look for young engineers who know their ethics, it is going to be up to us in the colleges to teach ethics.

In the past, we have taught them to be reasonably competent in technology; but we have told them precious little about engineering ethics.

Metropolitan Toronto

By Frederick G. Gardiner, Q.C.

In the Toronto area a contributing factor to the creation of satellite municipalities around the city was the decision made by the city fathers in 1912 that there should be no more annexations. The Town of East Toronto was annexed in 1909, the Town of West Toronto in 1910 and the Town of North Toronto in 1912. These annexations gave rise to administrative difficulties, the city government contended that after each annexation the city taxpayer paid $2 for each $1 paid by the taxpayer in the annexed area to bring the municipal services in that area up to standards prevailing in the city. The decision that there should be no more annexations was as final as it was unfortunate; it failed to recognize that time marches on and that you cannot stand in the way of progress.

Over the forty years from 1912 to 1952 the metropolitan area became divided into 13 separate municipalities, composed of one city, three villages, four towns and five urbanized townships. Each was geared to a local pattern of development, none was much concerned about what was happening to its neighbour and none was interested in the general and proper development of the whole area. With this impractical and unrealistic development something was bound to happen and it did not take long to occur.

The Toronto and York Planning Board lined its walls with maps, but in the absence of power to tax the constituent municipalities nothing was accomplished. We had to be driven by intolerable inconvenience and the threat of financial difficulty to necessary steps to solve our problems. When some of our municipalities had difficulty in selling their bonds it was evident that a major operation was necessary.

This article is reprinted from The Engineering Journal, March, 1954, of The Engineering Society of Canada. Mr. Gardiner is chairman of the Toronto Metropolitan Council, Toronto, Ontario, Canada.

Though this paper is not directly concerned with engineering, it is of interest because it describes the organization of a form of administration designed to overcome the difficulties of municipal government in metropolitan areas. It discusses a unique venture on this continent, the operations of which are sure to be closely watched by engineers, so many of whom have a professional interest in municipal affairs.

Our article is a condensation of an address delivered before the Toronto Branch on December 3, 1953.

Toronto Metropolitan Act

The Toronto Metropolitan Act was the result of an application by the City of Toronto to the Ontario Municipal Board for an order directing the amalgamation of the 13 municipalities into one municipal corporation.

Eleven of the 12 suburban municipalities righteously and indignantly defended their local autonomy. In the face of violent and vitriolic opposition the Board concluded that it was not advisable to force the opposing municipalities arbitrarily into one amalgamated unit. On the other hand it recognized that the dangers inherent in the situation required early and effective action and so recommended that the Province pass legislation to establish a metropolitan system of municipal government for the whole area. Because of the comprehensive nature of the services which will be administered by the Metropolitan Corporation, the plan is unique in North America. The closest approximation is the London County Council in England, which is composed of 150 members from 28 boroughs and provides metropolitan services for 3½ million people.

The Metropolitan Toronto Act establishes a system whereby the 13 municipalities may preserve their identity and continue to administer those services which are local in nature and at the same time combine for the provision of those services which are metropolitan in nature. By establishing an additional level of government for the provision of metropolitan services, the way is left open for eventual amalgamation of the constituent municipalities if that is considered to be the best course to follow. On the other hand, if this new metropolitan form of government operates successfully, there may never be any necessity for actual amalgamation and enforcement upon the dissenters of that political union which they so violently oppose.

The services for which the Metropolitan Corporation is responsible are water supply, sewerage and sewage disposal, housing, education, arterial highways, metropolitan parks, certain welfare services and the overall planning of the area.

Responsibility for Services Outlined

With respect to water supply, on January, 1954, the Metropolitan Corporation will automatically become the owner of all pumping stations, treatment plants, reservoirs and trunk mains in all the 13 municipalities. No compensation for these works will be paid to the local municipalities, but the Metropolitan Corporation will assume outstanding debentures issued in connection with their establishment. The Metropolitan Corporation will sell water to each of the 13 municipalities by meters at a rate sufficient to pay the cost of the operation and extension of the metropolitan water system. The local municipalities will continue to own their water distribution systems and will sell water to individual consumers at prices fixed by themselves.

With respect to sewage disposal the situation is the same. The Metropolitan Corporation will own all sewage treatment plants and trunk mains and will accept sewage from the 13 municipalities through meters at a fixed rate. The municipalities will retain their local collection systems and will charge their

residents for sewage service upon such basis as the municipalities may determine.

As to arterial highways, the Metropolitan Corporation will designate those highways which will become metropolitan roads on January 1, 1954, will assume the outstanding debentures issued for their construction and will pay the cost involved in the maintenance and extension of such highways. The Metropolitan Corporation will also undertake the building of future expressways, parkways and arterial highways and will provide the area with an adequate system. Metropolitan roads will be paid for 50 per cent by the Metropolitan Corporation and 50 per cent by the Province.

With respect to public transportation, the Toronto Transportation Commission, which has been a separate authority for 30 years, will be expanded into the Toronto Transit Commission. The new Commission will have a monopoly of public transportation in the metropolitan area, with the corresponding responsibility of providing public transportation throughout it. The Toronto subway, which is now nearing completion, will become the main stem of the transit system, which, with surface lines, trolley coaches and bus facilities, will provide the required public transportation.

All independent bus lines now operating in the suburbs will be acquired by the new Toronto Transit Commission on July 1, 1954. Compensation will be paid to their proprietors, such compensation to be settled by mutual agreement, or, if mutual agreement cannot be arrived at, by the Ontario Municipal Board.

Education, Health, Housing

In order to equalize the cost of education throughout the area, the Metropolitan Corporation will assume all outstanding debenture debt for schools in the whole area and will pay each year to the school boards in each of the constituent municipalities a maintenance grant of $150 for each primary pupil, $250 for each secondary pupil and $300 for each vocational pupil. This will permit each of the local municipalities to provide a reasonable standard of education for its children. If any local municipality desires to provide a higher standard of education than these payments will permit, it may do so, but at extra cost to its taxpayers.

The Metropolitan Corporation will be paralleled by a Metropolitan School Board, which will choose the location of new schools and coordinate the activities of each of the local school boards, which will be continued.

Certain health and welfare services, such as the hospitalization of indigent patients, the provision of homes for the aged and the maintenance of wards of children's aid societies, will become the financial responsibility of the Metropolitan Corporation. The Metropolitan Corporation will also provide and maintain a courthouse and a jail.

The Metropolitan Corporation will have all the powers of a municipality with respect to the provision of housing and redevelopment, which will be one of its major problems.

A Metropolitan Planning Board will have jurisdiction not only throughout the metropolitan area, but also on a regional basis, extending over each of the adjoining townships on the borders of the metropolitan area.

The Metropolitan Corporation is empowered to establish metropolitan parks and green belts; up to date it has been quite impossible to procure the necessary cooperation between the 13 municipalities.

Metropolitan Budget

The whole metropolitan undertaking will be financed by a metropolitan budget. The cost of operating the Metropolitan Corporation will be charged to the 13 municipalities in the ratio of their aggregate assessments. During the past two years, the Greater Toronto Assessment Board, established by the Provincial government, has been reassessing all the industrial, commercial and residential properties in each of the 13 municipalities on the same basis. This reassessment will be completed before December 31, 1953, so that each of the local municipalities will contribute to the cost of operating the Metropolitan Corporation in the ratio that its total assessment bears to the total assessment of the whole metropolitan area. The aggregate assessment of all properties in the metropolitan area will be approximately $2½ billion.

The Metropolitan Corporation will issue tax bills to each of the 13 municipalities. The metropolitan tax rate will be sufficient to provide the funds necessary for its current operation and to finance the capital expenditures to be undertaken. Each of the 13 individual municipalities in turn will incorporate its contribution to the Metropolitan Corporation in its local budget. Thus each municipality will pay its appropriate share to the Metropolitan Corporation and, in addition, will tax its taxpayers for the amount needed to provide the local services for which it remains responsible.

The local municipalities will no longer issue debentures for any of their requirements. If they need capital for local undertakings, they will apply to the Metropolitan Corporation to issue such debentures; if the Metropolitan Corporation agrees that the debentures should be issued it will issue them; if the Metropolitan Corporation considers that such debentures should not be issued, the local municipality may appeal to the Ontario Municipal Board, whose decision is final. All debentures will be backed by the total assessment of the whole area. In respect of debentures issued for the account of a local municipality, that municipality will tax its proprietors each year an amount sufficient to carry the annual payments necessary to amortize such debentures.

The Province of Ontario, recognizing that substantially increased expenditures will have to be made to correct a situation which is the accumulation of 40 years of unsound municipal development and that the only tax source for municipalities is real property has established a system of grants which will be made by the Province to the Metropolitan Corporation. The Provincial grant will be $4 per capita; as there are approximately 1¼ million people in the Metropolitan area, the Metropolitan Corporation will receive initially from the Province about $5 million. This Provincial contribution will lighten the burden on the taxpayers of the area and will make it possible for the necessary metropolitan services to be provided over a reasonable period, in accordance with well defined plans and without increased taxation.

In addition to the annual grant, the Province has paid the organization costs of the Metropolitan Corporation up to January, 1954, when the Metropolitan Corporation actually takes over the administration of metropolitan services.

Council of Elected Members

The Metropolitan Corporation will be governed by a Metropolitan Council of 24 members, which is already in operation. Twelve members are from the City of Toronto and 12 are from the 12 suburban municipalities. In order that the plan may conform to the accepted principle that there should be no taxation without representation, the 24 members are elected members of their local councils. The 12 from the City of Toronto are the mayor, the two controllers who led the poll at the latest municipal election and the 9 aldermen who led the poll at that election. The 12 representatives from the suburbs are the heads of their respective municipalities, whether they be mayors, as is the case in the four towns, or reeves, as is the case in the three villages and the five townships.

For the rest of 1953 and for 1954, the chairman of the Metropolitan Council was appointed by the Province commencing on January 1, 1955, the 24 members of the Metropolitan Council will elect their own chairman from among their own number or from outside, as the council decides.

This metropolitan system of municipal government is the solution offered by the Province of Ontario for the problems that confront metropolitan areas. It is a calculated attempt to allow the municipalities in a metropolitan area to preserve their autonomy in respect of matters which are local in nature and to combine them for the provision of municipal services which are metropolitan in nature.

Leedy Is President of Anti-Pollution Group

Dr. Haldon A. Leedy, director of Armour Research Foundation of Illinois Institute of Technology, has been re-elected president of the Midwestern Air Pollution Prevention Association.

Leedy will serve for the fourth year as president of MAPPA, an organization set up in 1951 to help control Chicago's air pollution.

The election was held June 22 as part of MAPPA's annual meeting, at which time a report was made by Armour Research Foundation scientists on the first phase of a continuing $20,000 study of Chicago's air pollution.

Other officers elected were:

First vice-president — L. A. Evans, president and general manager, Chicago and Western Indiana Railroad company and Belt Railway company, both in Chicago.

Second vice-president—Gustav Egloff, MWSE, director of research, Universal Oil Products company, Chicago.

Treasurer—Douglas R. Fuller, vice-president of the Northern Trust company, Chicago.

Secretary—Fred T. Mommsen, assistant director, Department of Air Pollution Control, City of Chicago.

CTA Buys More Propane Vehicles

Purchase of an additional 100 propane buses, increasing CTA's fleet of these odorless transit vehicles to 1,051 units, was authorized on July 9 by Chicago Transit Board.

These latest additions to CTA's propane bus fleet are to be manufactured by the Flexible Company and the Twin Coach Company at Loudonville, O., and will cost approximately $19,860 each, or a total of $1,986,000. The joint bid of these two companies was the lowest, other bids being submitted by the Mack Motor Truck Corporation of New York and the Marmon-Herrington Co., Inc., of Indianapolis.

According to V. E. Gunlock, MWSE, new chairman of Chicago Transit Board, this purchase brings CTA's investment in modern transit vehicles, and other modern facilities such as garages and shop tools, to approximately $95,000,000. This is the most extensive transit modernization program in Chicago's history, and one of the most extensive in the nation in a similar period of time.

Delivery of the 100 new buses, which are to seat 48 to 52 passengers, is to start within five months, and is to continue at the rate of two buses per weekday until the order is completed.

CTA is now receiving delivery of 400 similar propane buses, purchased on three recent competitive bid contracts awarded to The Flexible Company and the Twin Coach Company. Only 52 of these 400 buses remain to be delivered as of the above date.

With delivery of the 100 buses purchased on July 9, modernization of CTA's surface fleet will be more than 95 per cent complete.

CTA is receiving delivery also on a recent purchase of 250 all-metal rapid transit cars being fabricated by the St. Louis Car Company of St. Louis, Mo. These additions to the rapid transit fleet will bring rapid transit equipment modernization to more than 70 per cent of completion.

Machine Gun Information Released

The story behind a new, high performance machine gun, currently being used as standard aircraft armament, was released April 28, as the U.S. Ordnance Corps relaxed security restrictions.

The gun is an automatic revolver-type 20mm gun capable of "very high rates of fire," according to engineers at Armour Research Foundation of Illinois Institute of Technology, Chicago, who helped develop the weapon.

The machine gun, recently standardized as the M39, is the result of more than seven years of intensive research and development, administered by the Ordnance Corps with funds furnished by the Air Force and Navy.

Earl M. Wintermoyer, supervisor of small arms research at the Foundation, and Eugene S. Wassel, assistant supervisor, explained that details of performance are still classified by the government but "this weapon fires at rates considerably higher than conventional weapons."

Wintermoyer said that the gun is based upon the German prototype, MK213, designed and built by Mauser-Werke at Oberndorf, Germany.

"An early model of the German gun was captured near the end of World War II, after it had been badly damaged by fire," Wintermoyer said. "Because of the pressure of the war the Germans never developed the gun for production."

The original research contract to develop this weapon was sponsored by Army Ordnance and awarded to Armour Research Foundation in the spring of 1946. The early work consisted of the study and analysis of the design features and operating principles of the MK213. These principles involve the use of a multi-chambered drum which is indexed by a gas-operated slide mechanism to bring the chambers successively into alignment with the barrel.

"We reconditioned the weapon so that we could get some preliminary performance data in firing tests," Wintermoyer continued. "Then we reworked and modified the weapon for more extensive firing.

"These studies led to the design and construction of early development models with features very similar to those of the present production gun," Wintermoyer pointed out.

Early in 1950 the Ordnance Corps gave Armour Research Foundation a new contract to continue the development of the original German idea. "By this time we felt we knew something about revolver guns and we proceeded to design and build development weapons," continued Wintermoyer.

"We made Models A, B, C and D, each incorporating improvements and refinements. Springfield Armory made many of the major components for the development models. In March, 1951 the Ford Motor Company was given a contract by Ordnance to begin production development on our Model D design. Rock Island Arsenal also produced weapons based on this design.

"The Ordnance Corps requested ARF to work with Ford in a consulting capacity," Wintermoyer said. "Foundation engineers met with Ford personnel several times to explain design details and weapon functioning. In three months Ford built the first of its production weapons."

The final Ford production gun was based on the ARF Model E gun, Wintermoyer pointed out. The Foundation continued with its development program, resulting in improvements in design which were adapted to mass production by Ford.

"Recently the Ordnance Corps has brought Pontiac into the production picture, and now they're making most of the guns," added Wintermoyer.

He said Armour Research Foundation now is doing development work on an improved model of the gun.

"The task involved in starting with an idea and bringing it to the production stage is enormous," Wintermoyer pointed out. "On July 12, 1951, after six years of development we fired our first burst exceeding 100 rounds. We were so happy about it that we had a big dinner celebration."

Wassel, who has worked on the gun during the entire development, stated, "At ARF alone over 70 men have contributed at some time or other to the development of this weapon. To date we've turned 35 patent disclosures over to Ordnance."

Wintermoyer said "the real story behind this weapon is teamwork. Springfield Armory, our technical supervisors, gave very capable guidance to the work from the original German idea to the production stage."

Consulting Engineers Committee Approved

The Board of Direction of the Western Society of Engineers recently approved the formation of a Consulting Engineers' Committee to take the place of the Consulting Engineers Division. The following members were appointed: Frank A. Randall, Jr., chairman: Donald N. Becker; Leonard C. Childs; John Dolio; and C. H. Westcott. Anyone interested in the work of this committee is urged to contact J. Earl Harrington, the executive secretary, or one of the committee members.

Splitting the Inch

(Continued from Page 4)

In receiving inspection, it is necessary that the gage system of the supplier be in harmony with that of the purchaser.

Production inspection to assure maximum part acceptance finds it helpful to work to just slightly closer tolerances than final inspection if using fixed gages. However, proper instruments permit both manufacturing and final inspection to work to identical tolerances. Final inspection requires the best measuring equipment, including all desirable master reference gages which are periodically inspected to assure basic size maintenance.

Strong process checks are necessary in production control at predetermined stages to catch machining errors as quickly as they occur to avoid needless subsequent operations. Wherever feasible, gages at each machine just as accurate as those in final inspection are desirable. Otherwise, we almost make it impossible for the machine operator to produce good enough parts to pass final inspection.

And to maintain integrity of inspection processes, it is often desirable that the machine tool and the gage should be mutually independent. Fully automatic gages completely controlling some machines have their rightful place, but must be approached carefully because in the present art they sometimes undesirably limit this independence. An illustration is the inconsistent temperature changes during the varying amounts of metal removal which temporarily change the dimensions of the work part and prevent a true check by the automatic gage unless accurate allowance can be made for this varying condition. Additionally when interlocked,—failure of either gage or machine ties up both. In principle, I heartily favor a practical closer relationship between machine and gage.

When planning the processing, intelligent cooperation between engineering, production and all elements that determine quality is necessary in selecting gages, machine tools, fixtures, and other production equipment. All these latter should be processed simultaneously to avoid costly or awkward compromises later (e.g., to be sure common locating points are used both in manufacturing and gaging wherever possible).

Selecting the proper instrument permits visual magnification of the tolerance range to almost any desired degree. To a new grinder hand, a tolerance of two thousandths of an inch, two thirds the thickness of a human hair, might look difficult. Supply an instrument by which the two thousandths covers several inches on the gage scale and his nervousness disappears, for it robs the decimal of its power to confuse. The most important characteristics of a good gage are simplicity and dependability. It should show the operator the size of part he has produced and make it easy for him to apply this information.

Most of us are somewhat familiar with quality control systems. They depend upon statistical methods of analysis in conjunction with production charts visible to the operator who has a convenient gage. Strict maintenance of an unbroken production pattern permits reasonable reliance by final inspection on sound sampling techniques based on statistical history for many dimensions of varied character. However, there must be unwavering reliance on competent 100% inspection wherever dimensions are evaluated as critical or in the inspection of rejected lots.

There are interesting possibilities inherent in gaging at the machine in addition to those mentioned. Maximum life is secured from cutting tools. More acceptable parts are obtained in any given lot, with lower material costs and a saving of inspection time. Eliminated are the expensive assembly of teardowns whose components do not function properly because of inaccuracies. Sometimes there is a saving in inspection floor space. Gaging at the machine creates and opportunity restores individual pride of workmanship to the machine operator. Usually, for a few hundred dollars the instrument backs up and protects machines that often cost thousands of dollars and guards output and costs right at the source. Add the benefits of charting to these advantages and you have the most important accomplishments of any statistical quality control system.

Carefully applied to meet particular shop conditions, there is every reason to believe that dimensional and quality control will continue to develop in more and more widespread practical forms. Many leading universities such as University of Cincinnati, University of Connecticut, University of Detroit, University of Iowa, University of Michigan, Rutgers University, University of Tennessee and others are offering credit courses which are attended by more and more engineers and shop men.

While there is a growing need for the many useful fixed gages and single manual instruments, it is true that both multiple and fully automatic gages are also gradually finding their place in industry where high production and low cost are twin problems of engineering and manufacturing.

Checking from two to thirty and more dimensions simultaneously in the same time it formerly took to check one dimension offers obvious advantages. Multiple gaging first proved its value in World War II with multiple electric gages and more recently with air gages, or a combination of both.

Probably one of the most interesting recent accomplishments in gaging is that of checking jet engine blades and buckets. The instrument checks the contour of each side of the blade, blade thickness, whether it *leans* to the right or *tilts* from front to rear, determines if it is *bowed* and in what direction if any it may be *twisted on* its root. The float patterns show all these conditions and measure deviations.

Automatic gaging is desirable only on mass production and is an involved subject. Knowing what not to do is often as important as knowing what to do. It means freezing design, classifying and sorting parts and it is a supreme test for the gage designer and gage user—not a job for novices on either side.

In determining whether a particular application would be practical, it is best to adhere to the conservative side —perhaps a semi-automatic, or a simpler single, or multiple gage may do the job. The psychological factor needs to be considered. Occasionally, the thinking of manufacturing or inspec-

tion isn't ready for such a development, or peak production may not be planned for some time. Sometimes new and complex maintenance problems must be anticipated. The human element, including the intelligence level must not be overlooked in any kind of gaging system—automatic, multiple, statistical or otherwise. Not everybody is good at the three R's—and a few take almost juvenile delight in cribbing on engineering tolerances.

Even a good automatic gage should be applied cautiously for it inexorably segregates the acceptable from the unacceptable and lets the chips fall where they may. It plays no favorites. Top management must decide after a thorough, accurate and impartial study whether production is to meet the specifications on parts or if the part tolerances are to be changed. The gage manufacturer is helped if he is given the whole story so the gaging equipment may be made in accordance with total deviations. This will permit the gage to pass the greatest number of usable parts. With such an analysis, the high production gage can immediately start paying off in major savings. There are notable examples where meeting tolerances required for interchangeability has been most worthwhile. Conversely, there are also innumerable cases where overall manufacturing tolerances can be economically opened up and, if necessary, be recaptured then by classifying parts for selective fit.

This is an opportune time to mention that some of us are prone to wonder why a gage costs relatively more in relationship to its size than, let's say, a machine tool. I'm not so certain that it does, but as a manufacturer of both I am respectfully sure that both are worth their cost. Generally speaking, every measuring instrument or gage must be at least ten times as accurate as the work coming from the machine tool. Otherwise it wouldn't repeat with the necessary high degree of uniformity, and a gage that won't repeat is no gage at all. Second, and more important, the nine to one ratio lets manufacturing have at least ninety per cent of the part tolerance, since the gagemaker uses not more than ten per cent, and by instrument set-up this can be recaptured with calibrated masters.

Time does not permit the discussion of many fine instruments and machines, but it should be noted that actually multiples and automatics represent a small fraction of the millions of dollars American industry has economically invested in gages and measuring instruments. The overwhelming portion of this economical investment justifiably continues to be made in single or manual type gages and instruments.

In looking to the future, no one can claim a crystal ball. Yet it is apparent first that additional widespread use of selective or classified fitting will continue to expand and develop. A second forecast must include a picture of intense usage of instruments—single and multiple gaging of parts at the machine —as inevitable when considered against the practical and hard necessity for constantly reduced labor and material costs per unit. It points to ever more widespread dimensional control in keeping pace with inevitable increasing mechanization of mass production. Third, probably "indicating feed gages" that continually show the operator the position of the slide movement of his machine tool in relation to the correct operating depth will become a more common application. This will give the operator a constant means of keeping his work either to the high or low side of tolerance, or in center, whatever is most desirable, and other advantages.

In a practical attempt to further view the future, I quote briefly from a paper given by Colonel J. G. Schneider, Acting Chief of Quality Control, the Air Materiel Command, at a recent American Ordnance Association meeting at West Point.

"After all, Quality Control is simply a broad term which covers among things all the measurement techniques which are used, under a wide variety of circumstances to make sure that a product conforms to some established quality standard. The whole Quality Control edifice is built on sound gaging practice. The greatest Quality Control engineer alive couldn't organize an effective Quality Control program without accurate and dependable measuring equipment. It need hardly be said, then, that Quality Control can't make much progress unless the gaging industry provides instruments to help solve its problems, to measure dimensions and quality characteristics which, in our day and age, are becoming so minute and elusive that they almost defy instrumentation."

Colonel Schneider gives us an insight into the problems of today and tomorrow and, with instrumentation possessing magnification up to one hundred fifty thousand times already being tested in laboratories, there need be no question that the future will enable the further splitting of millionths to whatever ulimate degree required by the almost infinite projections of desired precision accuracy.

Of course, the gage industry has its troubles, too, including very special and difficult handicaps. History has shown a record of amazing business peaks during times of national emergency, followed by deep and devastating valleys. For example, contrasting the highest month of World War II with the lowest

month before Korea, we find a shrinkage of more than ninety per cent in incoming gage orders for those two particular months. You know how such drastic reversals disrupt manufacturing procedures, capacity and progress. It is almost impossible to rapidly contract and expand an organization that requires such highly skilled personnel with the necessary years of experience and know-how—and it is very expensive. The gage industry does appreciate your sympathetic understanding and intelligent cooperation in these problems, for you know that engineering, production, quality control and inspection men, everywhere, form the team that, after all the troubles are aired, still have to come up with the answers and produce a quality product at competitive costs.

In summarizing these remarks about a vitally important part of the modern production team, let's refer to the earlier comment which noted that gages really represented management, whether we think in terms of engineering, production, purchasing, administration, etc. While gages do not inspect quality into a product, neither does management actually produce automobiles, refrigerators, bearings, gages with bare hands either. Yet take away the executives from all phases of management, and you know how quickly operations can get out of control. Fail to supply adequate gages, the mechanical representatives of management—and the same thing can happen. So—just between us—I honestly don't believe gages are a bit more indispensable than we executives. Wouldn't we hate to run a business without ourselves!

All joking aside, gages—like mass production—are here to stay because they help make interchangeable parts and the assembly line possible with all the resulting benefits to the general public at home, on the highways, seas, and in the skies.

Of course, the engineering profession particularly is aware that as man's industrial progress grows through new engineering developments which require the inch to be divided finer and finer, it will mean better household aids, finer automobiles, heating systems, electric appliances, etc. Bus lines, trains and airplanes will offer greater safety and better schedules, with more comfort and convenience. Product failure can be less, noise and vibration will yield to smoother operation with more economical performance. And while the public may not realize the indispensable connection between measuring instruments and beneficial interchangeable mass production, competent responsible management in every modern field does know that this industrial progress is safe for the future as industry continues to demand more and more precision.

And I believe you will also have noticed in his report that, while measuring instruments on the production lines everywhere have been dividing the inch *finer* and *finer*, they have also been reducing costs in practical fashion by becoming *faster* and *faster*.

Chemists to Look At Packaging, Labeling

An important all-day symposium on the transportation, packaging and labelling of chemicals will be presented October 13 during the Eighth National Chemical Exposition in the Chicago Coliseum Oct. 12-15.

The symposium has been arranged with the cooperation of officers of the Manufacturing Chemists' Association, of which William Foster is president and Maurice F. Crass, Jr., executive secretary.

The symposium will cover four major topics:

"The Economics of Chemical Transportation" will be discussed by John W. Keeler of Koppers Co., Inc., and Donald G. Ward of Mathiesen Chemical Corporation.

Their papers will cover the broad effect of transportation economics on the chemical industry and the industrial life of the nation, including rate structures, plant locations, population shifts and related subjects.

The panel on "Bulk Transportation of Chemicals" will be divided into three parts, with T. H. Caldwell of Dow Chemical Company discussing tank cars; W. E. Morgan of Union Carbide & Carbon Corporation, tank motor vehicles; and F. G. Moore of Columbia-Southern Chemical Corporation, tank vessels and barges. They will touch on such topics as technologic developments, products carried, safety factors and terminal facilities.

The last item on the program will be a panel discussion on "The Smaller Bulk Containers" in which the speakers and topics are: R. H. Long of Harshaw Chemical Company, metal drums and cylinders; L. B. Keplinger of Steel Shipping Container Institute, lining developments; Carl E. Pruett and E. I. duPont deNemours & Co., Ltd., plastic containers; H. W. Hamilton of the Chemical Specialty Manufacturers' Association, aerosols; and G. W. Benbury of the Pennsylvania Salt Manufacturing Company, fiber containers.

Instrument Congress Arranges Sessions

Richard Rimbach, managing director of the First International Instrument Congress and Exposition, has arranged the following sessions from the Foreign Trade Symposium during the period of the meeting, September 13 to 24, 1954 in the Philadelphia Convention Hall:

"Exporting Instruments," an Introductory talk by T. C. Ballagh of Ballagh & Thrall, Philadelphia Export Consultants, on September 17th.

"Foreign Trade Procedure," a Panel Discussion by Philadelphia Foreign Trade Experts in the fields of banking, customs house brokers, freight forwarding, etc. The panel will be moderated by T. C. Ballagh.

A foreign Trade Center will be open for consultation during the Congress and Exposition.

Work Is Resumed on Tunnel

The combined effect of large amounts of air blowing in and equally large amounts of water pumping out has made it possible to resume work on the hottest tunnel in recent construction history, Engineering News-Record, McGraw-Hill publication, reports.

Trouble on the project, a 6.4 mile tunnel (Cachuma Project's Tecolote Tunnel) in California, was caused by the unforeseen quantity and temperature of ground water encountered. The inflow of hot water, with water temperatures reaching 113 F, had caused the contractor to shut down work for almost a year, the magazine says. The tunnel has been made workable through the use of large quantities of dry air, moving air and cool air.

The problem of humidity, especially troublesome in such a confined space as a tunnel, is being overcome by speedy removal of incoming water. Before work on the tunnel was resumed, an underground pump room was installed some two miles from the portal; it contains two 3,000 gallons-per-minute pumps which are supplemented by a number of intermediate booster pumps along the entire length of the tunnel.

Compressed air, used for drilling and mucking operations, is dehumidified by means of after-coolers on the two compressors. The after-coolers do not provide cold air in the tunnel, since the air would warm up by passing through the hot tunnel; however, cooling the compressed air condenses the moisture in it.

Steps are being taken to supply cool air through the use of 125-hp air motors. The compressed air, as it operates the motor, undergoes expansion that supercools it. The potential energy of the compressed air is thus turned into useful work instead of heat, the magazine points out.

Blower Circulates Air

Air in motion is provided by a 200-hp blower which blows air into the tunnel by means of a 14-inch pipe (boosted by a second blower at the pump room). Although no attempt is made to remove moisture from the fan air, the low natural humidity outside the tunnel keeps the air relatively dry. The fan-driven air does pick up some heat as it passes through the tunnel; however, it still has a cooling effect.

Despite the extensive equipment to cool the air, the temperature in one section of the tunnel still reaches 100 F with 100 per cent humidity. When working or passing through areas such as this, workmen either ride in muck cars filled with water and leave only their heads exposed, or ride man-haul cars under a deluge of water which completely soaks the men. The evaporative effect as the train moves through the tunnel does the cooling. The water used comes from a relatively cool underground spring intercepted by the tunnel.

Comfort and Safety Stressed

During the most difficult temperatures and humidity conditions, the men worked for a while and then sat in the water-filled muck cars until able to get out and work again. Although nothing is known about the remaining 4,300 feet of the tunnel, it is expected that conditions will be about the same as they are, since there are indications that the water flow is tapering off as holding-through becomes imminent.

Each man applying for work is given a complete medical examination, including a chest X-ray and electrocardiograph heart test. As a result, there has been only one heat prostration case in the first two months of resumed work, as against many such cases before the shutdown. Safety engineers are at work nearly 24 hours a day, checking for presence of methane gas as well as recording water temperature readings at various points in the tunnel.

Yes Sir, It's a Fact!

Engineers make good husbands!

At least those who were graduated from Illinois Institute of Technology stay married, according to a survey of engineering graduates at the Chicago school.

No divorces were reported by three of the five classes included in the samplings of fifth year classes beginning with 1929, according to Earl C. Kubicek, Illinois Tech director of alumni relations and placement, who conducted the survey.

Returns revealed that approximately 90 per cent of the members of the classes of 1939, 1944, and 1949 were married, but that none was divorced. One divorce was reported in the class of 1929 and 2 per cent of the 1934 graduates were divorced.

"This is significant in view of the fact that one of every four marriages in the United States ends in divorce," Kubicek pointed out.

One of the contributing factors toward the low divorce rate, he explained, may be the relatively high level of security enjoyed by engineers.

"There has been a great demand for engineers in industry and engineering salaries have been increasing steadily for more than fifteen years," Kubicek said.

"Because they are better off financially, there may be less friction in their marriages over money problems, one of the major factors in divorce."

Kubicek sent questionnaires to 2,980 alumni—approximately 90 per cent of whom are engineering graduates. More than half of the alumni replied, which is an unusually high response for such a survey.

Educators, Others, Give Advice

Engineers should become more scientific, more creative, and more human.

This evaluation of today's engineering teaching was the dominant theme of the 62nd Annual Meeting—largest in history—of the American Society for Engineering Education, June 14 to 18 at the University of Illinois.

More than 1,400 engineers—mostly teachers from colleges in every state of the union and many foreign countries—registered for the meeting. They urged each other to devote more time to the basic sciences, engineering science, and the humanities—at the expense of engineering art or practice.

Industrial employers, agreeing with the educators, said that they were unwilling to have colleges sacrifice the sciences and humanities to provide time for studying technology or administration. They insisted that their sales, manufacturing and operating departments—as well as their research and development divisions—need engineers with strong scientific backgrounds.

The extent of this move to strengthen science is shown by the proposal in an interim report of the A.S.E.E.'s Committee on Evaluation of Engineering Education. This proposal would have all engineering students — whether majoring in chemical, mechanical, electrical, civil or other branches of the field—study in common almost five-sevenths of the total course. Only two-sevenths would be concentrated in the field of the major, and almost half of this would be as electives.

In his principal address of the meeting, Dean Linton E. Grinter, MWSE, of the University of Florida, retiring president of the A.S.E.E., said that colleges "must experiment with all possible methods of orienting engineering education more significantly toward basic and engineering science." Dean Grinter said that the engineer must be inherently creative, putting together a combination of theories, concepts, techniques, and experience in new and productive patterns.

The emphasis on science was continued by Dr. Lee A. DuBridge, president of the California Institute of Technology, who spoke at a celebration of the 50th anniversaries of the engineering experiment stations at the University of Illinois and at Iowa State College. "Maintain a close tie with the basic sciences," was Dr. DuBridge's advice. "An engineer, after all, is putting to practical use today what scientists discovered yesterday." Still more important, Dr. DuBridge stressed, is the fact that the work he must do tomorrow will grow out of what the scientist is working on today.

"The main purpose of science," said Dr. DuBridge, "is not to produce bombs and guns and radar—or even radios, refrigerators, and color TV, but to advance human understanding."

Despite the high purposes of science, too few high school students are being led to a study of science according to Major Lenox R. Lohr, MWSE, president of Chicago's Museum of Science and Industry. Major Lohr told the attendants at the annual banquet of the Society that only four per cent of Chicago high school students are studying physics and no more than one and one-half per cent are studying solid geometry. "Uninspired and inept instruction have too frequently made these all-important subjects a nightmare for the student," Major Lohr said. "The teacher should emulate the good salesman—be convinced of his subject's importance, know that his student has a vital need which he can supply, and induce the student really to want it by employing those devices which make it most palatable and persuasive."

Other highlights of the meeting, one of the largest in recent A.S.E.E. history, included:

1. The demand from industry and government for new engineering talent continues to be greater than the current supply. Donald S. Bridgman of the American Telephone and Telegraph Company reported a national survey indicating that the decline in business activity and defense orders in 1954 has led to a 20 per cent decrease in the need for engineering graduates. But, he said, "with the relatively small classes graduating at this time, there is still substantial unfilled demand."

"It is apparent," Dr. Bridgman continued, "that the most important elements in this problem now can hardly be reduced to numbers. Underlying all of them are the critical international situation and the demands it may create." In this connection, Dr. Bridgman noted that Russia is estimated to have graduated 43,000 engineers in 1953; the comparable figure for the U. S. is 24,000 in 1953 and only 19,000 in 1954.

2. Dr. Eric A. Walker, dean of Engineering at the Pennsylvania State University and chairman of the Engineering College Research Council, pointed out that "The colleges of engineering of the United States must be allowed to get into atomic research if they are to support and conduct a vigorous and up-to-date educational program preparing for careers in the general field of atomic energy.

3. Richard W. Schmelzer, assistant to the president at Rensselaer Polytechnic Institute, and chairman of the A.S.E.E.'s committee on incentives for good teaching, proposed this formula for adding to the stature of college teaching in America:

"We need to create a climate of opinion so that the man who devotes himself primarily to teaching won't feel apolo-

getic about it—won't feel that he is not a valued member of the university community; won't feel that he is playing second fiddle to a researcher or a writer of textbooks; won't feel that it is somewhat futile to devote his efforts to making himself as good a teacher as he possibly can."

4. A special A.S.E.E. project to study the teaching of humanities and social sciences to engineers, financed by a $30,000 grant from the Carnegie Corporation, got underway the middle of June at the University of Illinois with a two-day workshop session.

The goal of the project is to recommend ways by which engineering student's work in these liberal arts subjects may be strengthened. During the next several months teams of field workers will visit campuses to study the programs now under way at each school and to estimate their effectiveness. Edwin S. Burdell, president of the Cooper Union, New York, is project chairman.

Shell Transformer Has New-Type Core

A new design for scrapless laminations used in shell-type transformer cores has been developed by Armour Research Foundation of Illinois Institute of Technology, Chicago.

The new lamination would yield transformers that are lighter in weight than those made with conventional scrapless laminations, according to Harold L. Garbarino, electrical engineer at the Foundation.

Another advantage, Garbarino said, is that better joints can be obtained because of the way the new lamination goes together, thus giving lower no-load current.

The new design yields laminations having proportionately larger window space (open area) than those in the commonly used laminations. Garbarino expects this feature to be especially useful in high-voltage applications, where more core window space usually is required.

Scrapless laminations, Garbarino explained, are designed in such a way that they can be punched from sheets or rolls of magnetic steel without any scrap. The new design is not expected to replace older designs but rather to supplement them in certain applications.

Tiny Gage Helps Atom Study

A miniature gage which will enable scientists to make more efficient studies of pressures resulting from nuclear explosions has been developed at Armour Research Foundation of Illinois Institute of Technology, Chicago.

The pressure gage, probably the smallest of its kind ever made, can measure pressures as low as those from a breeze to those that would demolish the sturdiest of buildings.

"Its chief use at present is in small models used in laboratory studies of atom bomb blasts," said Fred Mintz, supervisor of mechanics instrumentation and vibration at the Foundation.

The "business end" of the gage measures one-eighth inch in diameter, Mintz said. Several dozen of the gages can be mounted in the models. Information on how to make the gages is shared with other organizations throughout the country studying blast effects.

Abe Siegelman, who was project engineer on the gage development, explained its background:

"Several of the Foundation's projects were set up to gather information about the effects of atom-bomb blasts—without using atom bombs. Information on blast effects can be obtained with the use of a shock tube."

"The shock tube is simply an 18-foot long tube with an 8-inch square cross section, he explained. Tubes of other dimensions also are in use.

Air pressure is built up in a chamber at one end of the tube, then released suddenly when a plastic partition is pierced. This produces a pressure wave, or shock wave, which travels down the tube.

The shock wave, traveling the length of the tube, simulates an atom blast. At the far end of the tube, a model is mounted. The model is a small metal block, but the blast pressure measurements on it can be used to predict effects on most types of structures.

The tiny pressure gages are installed at a number of points on the surface of the model to measure the blast effects.

"The gage's chief use is in measuring the rapidly-changing pressures resulting from explosions," Siegelman explained. "It can be used almost anywhere to measure blast pressure on small areas.

"One of the gage's most important characteristics is its rapid response to changing pressures. With most other types of pressure gages, there is a lag between the time the gage senses the pressure and the time it records it.

"With our gage, the lapse is measured in millionths of a second—almost instantaneous."

The idea behind the operation of the pressure gage is comparatively simple, Siegelman asserted. The gage converts the blast pressures into electrical voltages. The electrical output varies with the amount of pressure the gage senses.

The voltage, in turn, actuates a recording device which gives a permanent record on film of the pressure change.

The sensing part of the gage consists mainly of a tiny tube of ceramic material called barium titanate. The blast puts a pressure on the surface of the gage, and the surface relays this pressure to the barium titanate tube, Siegelman said.

The pressure actually squeezes the

tube a few millionths of an inch out of shape. It is this squeezing action that generates the voltage. This is referred to as the piezo-electric effect and is similar in operation to the new-type ceramic phonograph pickup used on record players.

Tricky Cement Pour Takes Tons of Steel

Twenty-one thousand square feet of formwork supported by 55 tons of scaffold-type steel shoring were required for the relatively small pour of concrete—less than 300 cubic yards—in the thin-shell dome roof of the Massachusetts Institute of Technology's new auditorium, according to Construction Methods and Equipment, McGraw-Hill publication. Cause of the tricky pour was the dome's unique shape—a segment of a 112-foot radius sphere cut so as to make an equilateral spherical triangle.

The dome, with a 160-foot chord length along each curved side and with a rise of 45 feet, is supported only at its three corners. Average overall thickness is little more than four and three-fourths inches, the magazine says. To support formwork for this dome, more than 1,400 sectional steel shoring frames with adjustable legs were erected. For the forms, double 2x10-inch timbers on edge were set atop the shoring frames to act as sills.

All of the underside of the dome had to be formed up, but exterior forms were needed only at the three corners. Because of the steepness of the slope (up to 54 deg.) outside forms were carried to a height of 20 feet.

The entire dome was concreted in three separate 95-yard pours, the magazine continues; each pour was started at a corner and was carried up to the crown and the midpoint of the adjacent sides.

On the completed structural concrete dome, two inches of Fiberglas insulation is being placed and topped with a protective two-ply membrane waterproofing. On top of this will be a two-inch layer of reinforced poured concrete (for acoustical purposes). Completing the unique dome job is a sheathing of lead-coated copper roofing.

Thomas A. Edison Is Honored

Thomas Edison, the man who gave the world the first practical light bulb after countless experiments in his Menlo Park laboratory, is being honored in special Diamond Jubilee commemorative plans at The Henry Ford Museum and Greenfield Village during this year's 75th anniversary of his memorable invention of light, on October 21, 1879, it has been announced at Dearborn, Mich.

To celebrate the Diamond Jubilee and its own twenty-fifth anniversary, the Museum and Village, in cooperation with The Detroit Edison Company, General Electric Company, and Westinghouse Electric Corporation, are presenting special activities extending through the month of November.

The Jubilee celebration also marks the silver anniversary of the Museum and Village's dedication. In 1929, Edison's life-long friend Henry Ford brought the electrical genius's Menlo Park laboratory to Greenfield Village where it could be opened for all the world to see.

On the Golden Jubilee of Edison's noted invention of the electric light, the two were dedicated before a host of dignitaries including Ford, President Hoover, HM, WSE, Harvey Firestone, Madame Curie and other notables.

One phase of the celebration, "The Light We Live By," tells the story of lights and lighting from the days of the Pilgrims to the present. Covering more than 20,000 feet of floor space in the Museum, the extensive exhibit points up light's most significant advances during the past three centuries in a series of nine period rooms. Each room is lighted by its contemporary device to dramatize the contrast between old and new lighting methods.

A dramatic "Light Sorcery" show presented in the Museum Theater, features a light treatment of the entertaining and educational applications of modern-day lighting and lamps. The popular working demonstrations depict the step-by-step developments since Edison's invention in 1879. Included in the working demonstrations are phenomena performed with invisible infra-red, black light and flashtube equipment.

The central laboratory where Edison successfully completed his work on the first light bulb has been restored to its exact appearance three-quarters of a century ago. The Menlo Park group, with prototypes or replicas of many Edison inventions, is the most impressive reconstruction of any in Greenfield Village.

Among the inventions from the years 1876-1886 on display, in addition to the first electric light, are the phonograph; the electric pen, which was the forerunner of today's mimeograph; the Edison effect lamp, later used as a radio tube; and the carbon button transmitter which made practical Bell's telephone.

The apparatus used for the invention of the first light is still in operating condition, and is specially exhibited for visitors this season.

The Edison Illuminating Company, one of the earliest central stations for the distribution of electric power, has been completely renovated.

Today the illuminating company contains two of the original engines and generators from the Detroit plant and the only remaining "Jumbo" dynamo from New York's Pearl Street station, the world's first central power station. Jumbo, sole survivor of a fire which completely destroyed the New York station, was a center of attraction at the World's Fair in Chicago in 1939. Power from the old Edison generators is being used this year to light an immense 50,000 watt light, largest in the world when it was produced in 1936.

Other Edison memorabilia open to the public include many of the buildings

in which the famous inventor spent his boyhood days and subsequent later life. The house of Mrs. Sarah Jordan, which stood across the street from Edison's Menlo Park laboratory in West Orange, N. J., was the first private residence ever lighted by electricity. Now restored in Greenfield Village, the boarding house was used by many of Edison's bachelor assistants as a place to relax after a hard day's work in the laboratory.

The first electrically lighted street is also reproduced in Greenfield Village with originals or models of the first electric street lamps still in operation. Christie Street in Menlo Park will be lighted with power from the Edison machine shop generators, which have been restored to operating condition.

Memories of Edison's boyhood experiences are recalled in the Smith's Creek Depot, where Edison was once thrown off the railroad between Port Huron and Detroit for starting a fire in his baggage car laboratory. At the age of 14, Edison held the job of news and candy vendor on the Grand Trunk line, and, during free moments, experimented with chemicals in his makeshift laboratory.

Thorndike Saville Given Lamme Award

Dean Thorndike Saville of New York University College of Engineering, June 17 received the 27th annual Lamme Award of the American Society for Engineering Education.

It was presented at a banquet closing the society's 62nd annual meeting, held at Urbana, at the University of Illinois.

Dean Saville was cited "for his distinctive leadership in organizations for advancement of the engineering profession and of engineering education."

Prof. Thomas J. Higgins, University of Wisconsin, received the ninth annual George Westinghouse Award, recognizing him as an outstanding young teacher of engineering and was cited "for his tireless efforts in the interests of better teaching."

Engineer: "You're positive, now, that one bottle of this will cure my summer cold?"

Drug clerk: "Absolutely, Sir. Nobody has ever come back for a second one, at least."

CRERAR LIBRARY
News and Notes

The current lobby exhibit in the "Classics of Science" series is devoted to the *Sphaera Mundi* of Johannes de Sacro-Bosco. This manual on astrology by the 13th century scientist was the most widely used of early works of interest in the history of astronomy. Acceptance of the spherical form of the earth contributed to popularity of the work, which was much reprinted. Containing many illustrations, its fine woodcuts are notable, especially in the Venetian editions. Exhibited are five editions from the Crerar collections, two from the 15th and three from the 16th conturies.

* * *

In line with a policy of many years directed toward interlibrary cooperation in the Chicago area, there was set up recently a Joint Committee on Library Resources in Natural History of the Chicago Natural History Museum and Crerar Library. Preliminary discussions point toward a division of responsibility for natural history between the two library facilities. Attention to periodical sets is receiving initial attention in order that subscriptions and back files may be most readily available to interested parties.

Big Splash Is Made By Company

U. S. Steel's American Bridge Division is making a big splash with a new prefabricated steel swimming pool first developed at Gary, Ind.

The new pools come in four standard lengths measuring from 33 feet by 16 feet to 105 feet by 35 feet. They are adapted for the whole family with a shallow end of three feet for waders and a deep end for swimming and diving.

The pool has a low initial and operating cost. It is prefabricated in sections and can be delivered by truck to any destination with a minimum of handling equipment since no single section weighs more than one ton.

The new prefabricated steel pool is the outgrowth of an installation made 11 years ago at the Gary Steel Works Good Fellow camp located just outside Gary, Ind. This pool was the first all-steel pool fabricated by American Bridge. Each year hundreds of employes' children enjoy the pool during their summer vacation.

Each pool comes equipped with special features for easy adjustment to perfect line and level and is welded together on the job for safe, sure water-tight durability. It is completely adaptable to filtering and recirculating purification systems providing clear water in constant circulation with only one filling at the beginning of the season.

On Training —
Letters from Leaders

In the last issue of Midwest Engineer we published another of about thirty letters received from leaders of Chicago-area firms concerning shortcomings noted in the engineers in their employ. Many of the letters also suggested what the engineers should do to correct their deficiencies.

Significantly, the engineer's technical training is generally considered adequate. In the broad area of Human Relations, however, engineers seem often to be "under achievers," according to the viewpoint of the industrial leaders as reflected in their letters.

Here, then, is the next letter:

Dear Mr. Becker:

Replying to your letter of August 31 in which you ask for our viewpoint on deficiencies we see in engineers as they come to us for employment:

I can do no better than quote below two letters, one from the head of our Construction Department, the other from the head of our Engineering Department.

"Most of the engineers come to us shortly after graduation from leading engineering schools in this part of the country. At the time of their employment, the most common deficiencies are as follows:

"1. Poor use of English language particularly in the writing of reports, specifications, contracts, and business correspondence.

"2. Lack of understanding the correlation of the various branches of engineering and architecture as required in a complete construction project.

"3. Undeveloped powers of observation resulting in failure to see many things from which valuable lessons may be learned.

"4. Poor memory, which makes it impossible to retain the benefits of education and experience.

"5. Lack of imagination necessary for creative work.

"6. Failure to appreciate the economies of engineering, and to evaluate costs which can be justified.

"7. Lack of understanding in human relationships, making it difficult to assume leadership."

"The education of Engineers is likely to be too narrow—at least in some schools—and perhaps is due to insufficient length of the College Engineering course. The following items indicate my views on the deficiencies:

"1. In some instances the Engineer does not get a firm foundation in basic Engineering subjects, such as Physics, Chemistry, Mathematics, etc. This is of primary importance.

"2. Usually there is a great lack of knowledge or experience in the practical application of Engineering. This could be improved by a 5 or 6 year Engineering course, instead of the usual 4 years. The longer course would include certain periods of actual work in industry. Some schools now offer this type of Engineering training.

"3. Engineers not always have the ability to work with people—not necessarily Engineers—who have considerable interest or perhaps control of the project being developed. This should be stressed, not only because of the necessity of the Engineer to obtain this ability sooner or later, but to enable him to gain the benefits of the knowledge and experience from others with whom he is associated in his work.

"4. More time and effort should be spent in preparing the Engineer to properly analyze Engineering and other problems. The ability to properly evaluate data and reach the correct conclusion is of paramount importance to the Engineer. Usually there are several ways of doing an Engineering job.

To prepare a good analysis requires general knowledge of the business and knowledge of the operating practices. A training program for Engineers by the Company would be of value in this instance and generally in helping the Engineer to do a better job.

"5. Ability to present clearly in writing, or verbally, an Engineering project or analysis is frequently lacking and is obviously of great value.

"6. Business training, at least to the extent of Engineering Economics, is important. The correct Engineering solution should always be economically sound.

"7. Because of the considerable amount of work in the usual 4-year Engineering course, the Engineer may not have time to participate in general school activities and thereby miss the association with other people that might broaden his views and develop leadership. Some attention in this respect is needed.

"8. Few Engineers join and regularly attend Professional Engineering Societies. This should be encouraged, even in schools, but particularly later. Professional Engineering Societies offer many things, such as broader conception of the particular phases of Engineering involved, increased and new technical knowledge, acquaintance with top men in Engineering, opportunities to develop leadership, and many others.

"9. The ..... Industry would benefit if there were better training in Refrigeration given in Engineering Schools. Many schools give a smattering of Refrigerating Engineering work and it is usually a part of the Mechanical Engineering course. In view of the present-day broad use of Refrigeration, and particularly in our industry, believe this situation should be given attention."

Sincerely yours,

Engineering Societies Personnel Service, Inc.

New York Chicago Detroit San Francisco

These items are from information furnished by the Engineering Societies Personnel Service, Inc., Chicago. This SERVICE, operated on a co-operative, non-profit basis, is sponsored by the Western Society of Engineers and the national societies of Civil, Electrical, Mechanical and Mining and Metallurgical Engineers. Apply to ESPS, Chicago and the key number indicated. Prepared ENGINEERS AVAILABLE advertisements limited to 40 words, with typed resume attached may be submitted to ESPS Chicago by members of Western Society of Engineers at no charge.

OVER THE MANAGER'S DESK

August brings hot sultry dog days when everyone has a tendency to slow up. However, do not allow yourself to slow up if you are an employer of engineers. We still have a definite shortage of good engineering talent. Phone or send your job specifications to us as it still will take time to find suitable applicants for you and you will want to be all set for September.

If you are an engineer who is not happy in your present position, come in and register now as opportunities still exist for you to improve yourself, if you think you have talent which is not being used to the fullest.

B.H.A.

POSITIONS AVAILABLE

C-2016 PROCESS ENG. & TOOL DESIGN. Up to 42 yrs. old. 6 plus yrs. exp. in processing gears or general machine shop products. Know: gear mfg. of custom built small gears. For a mfr. of gears. Sal: $6000-7000. Location: Chicago. Employer will negotiate fee.

C-2041 DESIGN & PRODUCTION CAPACITORS. 2 plus yrs. exp. in design & mfr. of oil or wax paper capacitors. Know: Previous capacitor mfg. exp. Duties: design, starting new dept., & engineering of production and costs. For a mfr. Sal: $6500-8500. Loc: Chicago. Employer will pay fee.

C-2044(a) DESIGN & DEVELOPMENT—Grad. Mech. Recognized school. 0-5 yrs. plus exp. Duties: to analyze customers' needs, review existing techniques, establish design approach for new products & develop sound designs for manufacturer of communication equipment. Must be U.S. Citizen. Sal: Open—dep. on exp. Location: Chicago.

C-2044(b) DESIGN & DEVELOPMENT. Grad. Elec. Recorginzed school. 0-5 yrs. plus exp. Know: of communications and electronics. Duties: develop switching storage and similar circuitry embodying transitors and electron tubes for manufacturer of communication equipment. Must be U. S. Citizen. Salary: Open dep. on exp. Loc: Chicago.

C-2051(d) CHEMICAL PROCESS. Educ: Chem. Duties: in plant engrg. & tube processing will handle parts processing, cost reduction, quality control, methods, glass to metal sealing problems, & testing. For a Mfg. of electronics. Sal: up to $9500. Loc: Several. Empl. will pay fee.

C-2052 PROJECT ENGR. ME Age: 28-35. 5 plus yrs. exp. in des. & devel. of electro mech. devices such as program sequence timers, escape mechanisms, cam des. relays & switches. Duties: design & development of a complete line of products relating to the above. Sal: $6000-8000. Loc: Chgo. Empl. will pay fee.

C-2057(a) DESIGNER EE Age: 35. 5 plus yrs. exp. in fractional H.P. motor design. Duties: design & development of universal fractional h.p. motors. For mfr. of elect. products. Sal: $8000-$10,000. Loc: Chicago. Employer will pay fee.

C-2059(a) RESEARCH Grad. EE Age: 30-50. 5 plus yrs. exp. in systems & design work including a thorough knowledge of electronic design and specific knowledge of computer and/or fire control problems. Sal: $8-9000. Location: Chicago.

C-2059(b) SR. DESIGN ENGR. EE Age: 30-50. 3 plus yrs. of design experience including work in digital circuitry, storage problems, shift & storage registers & transitorized circuit. Sal: $7-7500. Loc: Chicago.

C-2059(c) DESIGNER SMALL MECHANISMS ME Age: 35-55. 5 plus yrs. exp. in design of small mechanisms within confined areas, involving mostly punched parts. Exp. with small die casting & moldings helpful. Sal.: $7-9000. Location: Chicago.

C-2066 PROJECT ENG. Grad. Mech. Age: 32-40. 5 plus yrs. exp. in des. & specs. of heavy eqpt. Know: Steel mill eqpt. Duties: design & preparation of specs. for machinery for steel warehousing purposes. Will involve about 15% of time traveling. Sal: $6-7000. Location: Chicago.

If placed in a position as a result of an Engineers Available or Position Available advertisement, applicants agree to pay the established placement fee. These rates are available on request and are sufficient to maintain an effective non-profit personnel service. A weekly bulletin of positions open is available to subscribers. Apply ESPS Chicago.

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928 MW SALES ENGR. CE 25 Nineteen mos. surveying, estimating construction costs, programming, maintenance work. Six mos. detailing reinforced steel for concrete structures. Twenty-two mos. instructor of airfield construction. $5200 Midwest.

929 MW METALLURGIST ME 30 Three yrs. supervise maintenance of mech. eqpt. Four yrs. lab. assistant in fuel, lubricants, metallography, and testing highway materials. Chicago $6700.

930 MW DESIGNER 33 Four & one half yrs. construct, install, operate & maintain instruments in connection with basic research. Analyze & repair from final test line. $4500 Chicago.

931 MW TESTING ME 28 Sixteen mos. testing, developing and writing reports on ventilating units and weather instruments, etc. Thirty-two mos. supervise estimating, train new personnel, and some planning of work orders. $4800 Chicago.

932 MW DEVEL. ENGR. EE 27 Fifteen mos. testing of electrical rotating auxiliary eqpt., development & technical writing in connection with electrical controls. Three yrs. instruction of railroad supervision. $6000 Midwest.

933 MW DEVELOPMENT 37 Eight yrs. experimental elec. test of traction motors and generators. Charge of engrg. testing of relay & contactors. $5700 Chicago.

934 MW IND. ENGR. & TEL. ENG. 35 Eight mos. production scheduling, production control, procedures for company advancement, inventory control, & preventive maintenance. Eight mos. developed process charts for radar equipment. $4500 Chicago.

935 MW IND. MGMT. ENGR. ME 26 Five yrs. resp. for development of special manufacturing machinery & processes. Experienced with automatic machinery, manufacturing process control, methods and plant layout. $6300 Chicago.

Cellophane Is Given Workout

Glamorous cellophane is wrenched and twisted, frozen and fried, sealed, folded, glued and printed—in fact, put to every conceivable test in the newly modernized Technical Service Laboratory of Sylvania Division Viscose Corporation.

Part of the world's largest cellophane plant, located in Fredericksburg, Virginia, this "proving ground" for cellophane is one of the most complete and up-to-date laboratories of its kind. Working under the direction of John D. Conti, technical service department manager, Sylvania technicians have developed important new equipment for cellophane testing and customer service experiments, successfully duplicating almost every field condition under which the film is used.

After the cellophane has gone on trial here, Sylvania knows that it is ready for the real test—exposure to varying conditions of temperature and humidity, unintentional mishandling and abuse, and the stresses and strains that are encountered on commercial wrapping, printing and bag forming machinery. Sylvania utilizes this laboratory to implement its own quality control program, and also to assist commercial cellophane users in solving their individual packaging problems.

When the cellophane is clamped between the vibrating jaws of the *flex-tester*, human error is eliminated when testing its durability. The jaws of this machine grip opposite edges of a sheet of cellophane, then move in a parallel plane, but in opposite directions, with counters attached to record the number of quick movements made before the film breaks. This unit is portable, enabling its use under varying conditions of temperature, and humidity.

Another valuable device developed here is the *adhesive tester*. With this testing instrument ten different adhesives are sandwiched simultaneously between two cellophane sheets and allowed to dry. This test permits appearance and durability comparisons between the adhesives under observation. By replacing the laborious and often irregular hand-lay-down method of testing adhesives, this machine greatly aids in the development of improved adhesive.

Cellophane's heat-sealability is tested by the ingenious *multiple sealer*. Twenty-five separate sealing heads make twenty-five separate cellophane seals at temperatures ranging from 170 to 400 degrees Fahrenheit. Reaction of the heat seal coating to these different heats can be studied quickly and easily under controlled conditions. Hence, it is not necessary to make many time consuming individual heat seal tests. A rotary sealer, with six separate units of varying degrees of temperature, is used for crimp-seal evaluation. This unit will be of value in the study of sealing problems that arise throughout the flexible packaging industry.

A practice in the new laboratory is the employment of motion picture studies to follow-up the operation of Sylvania cellophane on customer machines. Through movie playback sessions, technicians analyze cellophane's performance in the field. This trouble shooting technique spotlights mechanical difficulties so they can be eliminated.

All possible situations in which cellophane may find itself between the plant and final user have been successfully simulated. The laboratory incorporates an Arctic-like cold room and a humidity unit which can change the atmosphere from New Orleans' dampness to the dryness of the Sahara Desert.

Commercial refrigerated display equipment is available for testing shelf-life of packaged perishables under actual store conditions. In addition to the specially designed equipment, there is a representative group of standard equipment used throughout the packaging field, including a Transwrap, bag making machines and stationary and rotary heat sealing units. A specially designed press tests the printing performance of Sylvania film by both Flexographic and Roto-Gravure methods.

One major development of the Technical Service Laboratory, the Sylvania Web Conditioner, has already created much interest within the packaging industry. The conditioner is designed to replace moisture driven from film during the printing operation, thus improving the general appearance of the film, reducing loss in width from drying and stretching, and insuring a more uniform and normal quality product.

B & W Company to Furnish Exchangers

The Babcock & Wilcox Company has signed a contract to furnish two heat exchangers for the first full-scale nuclear power plant ever built in the United States, according to C. H. Gay, vice president in charge of B&W's Atomic Energy Division. The contract is with the Westinghouse Electric Corporation which has responsibility for the nuclear portion of the project under an agreement with the Atomic Energy Commission, Gay said. The Duquesne Light Company will build the electric-generating portion and will operate the power plant which is to be located on a site near Shippingport, Pa.

"The two Babcock & Wilcox heat exchangers are a new design; involves less expensive materials and fewer complex shop operations than those used in any previous units of this type," Gay said. "This is in keeping with the major aim of the project which is to demonstrate the economic feasibility of nuclear power."

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Ordnance Plant to Produce Soon

The final phase of construction is now under way and production is expected to start in November at the Army Ordnance Corps' new $21 million "Ball Powder" plant at Badger Ordnance Works, it was made known July 21 by Norl A. Hamilton, general manager, Explosives Division of Olin Industries, Inc., East Alton, Illinois.

Located near Baraboo, Wisconsin, Badger is a Government-owned Ordnance installation which has been operated under contract since 1951 by Liberty Powder Defense Corporation, a subsidiary of Olin. Up to now, Badger's two products have been propellant powders for artillery shells and rockets.

The new unit at Badger, designed and engineered by Olin Industries, will be the first Government-owned plant in the U. S. to produce smokeless powder by the Olin Ball Powder process. Ball Powder is a propellant powder for small arms ammunition used in pistols, rifles, carbines and machine guns up to .50 caliber and 20 millimeter. It has been thoroughly evaluated by U. S. and foreign ammunition experts and is considered superior to other types of powder for these purposes. The only other plant in the United States which uses this process is privately owned and operated at East Alton, Illinois.

Although construction will not be completed until next spring, the new Ball Powder plant is expected to start operations in November of this year with about 250-300 workers. This is expected to increase gradually.

Ball Powder was developed by Olin Industries as a sporting gun powder before World War II. After the military disaster at Dunkirk, Olin built a plant to supply the British need for Ball Powder. This was subsequently expanded, and most of the cartridges for the U. S. caliber .30 carbine were loaded with Ball Powder. After the war, Army Ordnance gave contracts to Olin to develop this powder into a standardized military propellant for other small arms ammunition.

One type of Olin Ball Powder is the extremely dense and powerful propellant used in the new light-weight military cartridge recently adopted by the North Atlantic Treaty Organization as the standard for NATO forces. This cartridge was developed by Army Ordnance, and is known as the "caliber .30 T65," as well as the NATO 7.62mm. It is approximately one-half inch shorter than the standard 30-06 military cartridge and has ballistic qualities comparable to those of the longer cartridge. The cartridge was made possible because of the high-density, high-energy characteristics and carefully controlled burning rate of Ball Powder which is produced by an "underwater" chemical process.

WSE Applications

In accordance with the By-Laws of the Western Society of Engineers, the following names of applicants are being submitted to the Admissions committee for examination as to their qualifications for admission to membership into the Society in the various grades, i.e., Student, Associate, Member, Affiliate, etc. All applicants must meet the highest standards of character and professionalism in order to qualify for admissions, and each member of the Society should be alert to his responsibility to assist the Admissions committee in establishing that these standards are met. Any member of the Society, therefore, who has information relative to the qualifications or fitness of any of the applicants listed below, should inform the Secretary's office. The Secretary's office is located at 84 East Randolph Street. The telephone number is RAndolph 6-1736.

9-54 A. B. Openshaw, Manager, Combustion Engineering Company, 105 W. Adams St.

10-54 Edward J. Steeve, Engineer I, Commonwealth Edison Company, 72 W. Adams St.

11-54 Andrew J. Snider, III, Sales Engineer, Combustion Engineering, Inc., 105 W. Adams St.

12-54 Charles E. Canney, Sales Representative, Universal Atlas Ceemnt Co., 208 S. LaSalle St.

13-54 Richard L. Thompson, Superintendent, John Burns Construction Co., 105 W. Adams St.

14-54 Alfred H. Belliveau (Rein.), Patent Engineer, Automatic Electric Co., 1033 W. Van Buren St.

15-54 Joseph L. Smith, Supervising Engineer, Commonwealth Edison Co., 72 W. Adams St.

16-54 William D. Holcomb, Works Manager, Reliable Electric Co., 3145 Carroll Av.

17-54 Waldemar E. Paulsen, Gen. Shops Supt., Public Service Company, 1319 S. First Av., Maywood, Ill.

18-54 Paul B. W. Gollong, Manager, Armour Research Foundation, 10 W. 35th St.

19-54 Alexander N. Andros, Structural Designer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

20-54 Thomas E. Resch, Chief of Party (Survey), Greeley, Howard & Norlin, 1267 W. Washington Blvd.

21-54 Waldemar S. Styzinski, 902 N. Damen Av.,—attending University of Illinois, Navy Pier.

22-54 John F. Atkinson, Vice Presiednt, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

23-54 Robert Baskin, Structural Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

24-54 Kanwal S. Bawa, Foundations Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

25-54 Zevel Berman, Structural Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

26-54 Arthur S. Brock, Chief Engr. of Bldg. Structures, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

27-54 Richard W. Brusenback, Soils Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

28-54 James Buchmann, Draftsman, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

29-54 Robert E. Frederick, Civil Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

30-54 Joseph C. Fries, Assist. Project Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

31-54 Voldemar Grabinskis, Draftsman-Designer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

32-54 James R. Gray, Secretary-Treasurer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

33-54 Donald W. Hammerquist, Soils Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

34-54 Richard A. Julian, Instrument Man, Frank J. Kornacker & Associates, 115 S. LaFayette, South Bend, Ind.

35-54 Eugene Lantski, Designer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

36-54 Ernest V. Mathison, Structural Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

37-54 Joseph R. McClure, Chief Field Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

38-54 Raymond F. Noll, Assistant Bridge Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

39-54 Frank Olearnik, Draftsman, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

40-54 José F. Olivares, Junior Struct'l. Engineer, Kornacker & Associates, 53 W. Jackson Blvd.

41-54 Richard E. Pages, Draftsman-Designer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

42-54 Phillip A. Pearson, Chief of Survey Party, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

43-54 Bernard C. Prusinski, Structural Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

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47-54 Joseph Sikorsky, Field Soil Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

48-54 Vladas Sinkevicius, Designer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

49-54 Ursa C. Stringer, Charge of Survey for Design Drawings, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

50-54 Arthur L. Tuttle, Chief of Survey Party, Kornacker & Associates, Inc., Lafayette Bldg., South Bend, Ind.

51-54 Nathan D. Wilson, Bridge Engineer, Kornacker & Associates, Inc., 53 W. Jackson Blvd.

52-54 Vincent P. Reilly, President, Illinois Gear & Machine Co., 2108 N. Natchez Av.

53-54 William M. Readey, Public Relations Director, Plumbing Contractors Association of Chicago, 205 W. Wacker Dr.

Seek to Reduce Engine Noise

How can industry reduce machinery noise?

This question will be the theme of the fifth annual National Noise Abatement Symposium to be held Oct. 21 and 22 on the Illinois Institute of Technology campus, Chicago.

The symposium will emphasize noise reduction in order to make people more conscious of what can and has been done in the field of noise abatement, according to Stannard M. Potter, symposium chairman and supervisor of sound and vibration control at Armour Research Foundation of Illinois Institute of Technology.

More than 300 industrial, civic, and research leaders are expected to attend the two-day symposium to be held in Illinois Tech's Chemistry building, 33rd street and Dearborn avenue.

Factory problems will be analyzed in discussions on noise control of machinery, handling materials, testing products, and the sales appeal of quiet products.

Reduction of noise in household appliances such as fans, air conditioners, and refrigerators will be surveyed in another session on home noises.

Other sessions on vehicles will include talks on everything from subways to aircraft noises.

Included in the meeting will be a tour of the acoustical laboratories of Armour Research Foundation and a series of roundtable discussions on the following:

—Recent developments in noise abatement legislation.

—Medical advances in hearing problems.

—Psychological aspects of noise as they affect sales of machinery.

—Vehicle and construction noises in cities.

The symposium program was planned at a June 29 meeting in Chicago. The meeting was attended by representatives of the following sponsoring organizations:

Armour Research Foundation, Acoustical Society of America, American Medical Association's Council on Industrial Health, American Society of Safety Engineers, National Noise Abatement Council, American Society of Planning Officials, American Industrial Hygiene Association, and Acoustical Materials Association.

Chemical Association To Study Marketing

A symposium on exposition marketing of chemicals, arranged by the Chemical Market Research Association, will be one of the features of the Eighth National Chemical Exposition in the Chicago Coliseum October 12 to 15, 1954.

The symposium will be presented during the afternoon of Tuesday, October 12.

That evening at a dinner in the Palmer House, the American section of the Society of the Chemical Industry will present the 1954 Chemical Industry Medal to Dr. E. H. Volwiler, president and general manager of Abbott Laboratories, North Chicago, Ill. Dr. Volwiler will deliver an address, but the program is not yet complete.

The program on exposition marketing, beginning at 2 p.m., will present five speakers, who will then lead in a discussion program. The speakers and their subjects will be:

C. A. Harrington, Indoil Chemical Company, introductory; E. S. Nelson, International Minerals and Chemicals Corporation, "Principles of Industrial Product Promotion"; W. A. Lang, Monsanto Chemical Company, "Guides for Exhibitors"; E. P. Sutorius, Gardner Displays Company, "Case Histories."

The Exposition will also present an important all-day symposium on packaging and transportation of chemicals on October 13, 1954.

Reviews of Technical Books

Insulation

The Insulation of Electrical Equipment, edited by Willis Jackson, John Wiley & Sons, New York, 1954. 340 pages. $7.75.

The book covers the subject with direct reference to the design, manufacture, and testing of electrical equipment.

This new book is the result of lectures at a post-graduate summer session held in the Electrical Engineering Department of London's Imperial College. The twelve authorities who delivered these talks were especially concerned with design limitations and the best means for their removal.

Listed in order, the chapter headings are: "An Historical Survey of the Development of Electrical Insulation" by Willis Jackson; "General Properties of Insulation in Relation to Its Structure" by C. G. Garton; "Permittivity and Dielectric Loss" by L. Hartshorn; "Dielectric Breakdown" by S. Whitehead; "Classification and Review of Insulating Materials" by R. Snadow; "Communication Components" by I. M. Ross; "Power Cables and Capacitors" by L. G. Brazier and R. S. Vincent; "Electrical Machines" by E. Jones; "Power Transformers" by D. Macdonald; "Switchgear" by P. G. Ashley; and "Insulation Testing in the Laboratory, Factory and Field" by J. S. Forrest.

Dr. Jackson, Director of Research and Education with the Metropolitan Vickers Electrical Company in England, was formerly professor of electrical engineering at the Imperial College.

R.C.

Statistical Analysis

Statistical Analysis in Chemistry and the Chemical Industry, edited by Walter A. Shewhart, John Wiley & Sons, New York, 1954. 724 pages. $8.00.

Statistical Analysis in Chemistry and the Chemical Industry is sponsored by the Committee on Applied Mathematical Statistics of the National Research Council, and is the latest addition to the Wiley Publications in Statistics, edited by Walter A. Shewhart.

Written by Carl A. Bennett and Norman L. Franklin, the book was prepared at a level between works on mathematical statistics and those dealing almost entirely with the application of statistical methods. The authors first develop, in a logical sequence, the principles of statistical inference, and cover descriptive statistics, probability and samples, mathematical machinery, and statistical inference. In the second part of the book, they develop specialized methods and include relationships between variables, analysis of variance, the design of experiments, analysis of counted data, control charts, and some tests for randomness.

The authors have chosen those techniques most frequently used in the chemical industry. Their selection of methods is also based on the degree of correspondence between the practical situations from which data are obtained and the mathematical models on which inference from these data must be based. In cases where more than one method is used to achieve the same result, the authors present the theoretical, computational, and practical considerations on which an appropriate selection should be based.

Dr. Bennett is chief statistician with the General Electric Company in Richland, Washington. Dr. Franklin is lecturer in chemical engineering at the University of Leeds in England.

The members of the Committee on Applied Mathematical Statistics are: L. P. Eisenhart of Princeton University, chairman; C. I. Bliss of Yale University; E. U. Condon, Corning Glass Works; H. O. Gulliksen of Princeton University; L. J. Reed of Johns Hopkins University; C. F. Roos, The Econometric Institute; W. A. Shewhart of the Bell Telephone Laboratories; the late H. M. Smallwood; F. F. Stephan, Princeton University; and S. S. Wilks of Princeton University, secretary.

R.C.

A. C. Machines

Alternating Current Machines, third edition, by Puchstein, Lloyd, and Conrad, John Wiley & Sons, New York, 1954. 721 pages. $8.50.

Describing construction, principles of operation, methods used for making and working up tests, and simple methods for predicting behavior, regulation and performance, this well-known text now introduces significant new changes while retaining most of its original form. The authors have modified the approaches to the theories of some of the machines, and provide more detailed developments of equivalent circuits, vector diagrams, methods of calculating the cross-axis voltages of synchronous machines, and the equations describing the oscillations of synchronous motors. Both the double-revolving field theory and the cross-field theory have been retained for the single-phase induction motors, and additional material has been added in the latter to clarify the polarities of the transformer and speed voltages.

New material is also provided on adjustable-speed drives, rectifiers, and self-synchronous machines. Methods of determining the constants of synchronous machines have been added, and the authors explain the nature of short-circuit currents in alternators on the basis of the constant flux-linkage concept.

A. F. Puchstein, a consulting electrical and mechanical engineer with the Jeffrey Manufacturing Company in Columbus, Ohio, was formerly associate professor of electrical engineering at the Ohio State University. T. C. Lloyd is chief engineer at Robbins and Myers, Inc., in Springfield, Ohio, and was formerly associate professor of electrical engineering at Antioch College. A. G. Conrad is professor of electrical engineering and chairman of the department at Yale University, as well as a Fellow of Timothy Dwight College.

R.C.

WSE Personals

Dr. William A. Lewis, MWSE, dean of the graduate school at Illinois Institute of Technology, is en route to Brazil where he will attend two professional conferences and participate in a study tour of power plants and industrial installations.

Dean Lewis will attend the sectional meeting of the World Power conference in Rio de Janeiro on July 25. The study tour will follow the World Power session and will incorporate the Pan American Federation of Engineering Societies meeting in Sao Paulo on August 2.

The trip has been made possible by a National Science Foundation grant, made in recognition of the desirability of closer liaison between the American Power conference, sponsored by Illinois Tech, and the World Power conference.

* * *

Ralph K. Behr, MWSE, will become manager of the Boston district office of The Babcock & Wilcox Company's Boiler Division on Sept. 1 replacing H. K. Dean who is retiring after 31 years of service with the company, according to S. T. MacKenzie, Boiler Division sales manager. Dean has been manager of the district office in Boston for the past 13 years.

Behr, a native of New York City, graduated from Stevens Institute of Technology in 1926 with a degree in mechanical engineering and received additional training at Brooklyn Polytechnic Institute and New York University. He was associated with Stone & Webster, Inc., and Lowell Gas Light Company for a short time before joining Babcock & Wilcox in 1928. He had been attached to B&W's Chicago district office for 17 years prior to his latest promotion.

* * *

Dr. Gustav Egloff, MWSE, visited a number of places during the month of June, attending meetings, and giving talks. First he visited Washington, D. C., where he attended a meeting of the Petroleum Research Fund Committee of the American Chemical Society. A day or so later he addressed the graduation class of the Chicago Technical College, at the ceremonies held at the Museum of Science and Industry. On Sunday, June 20, he flew to Denver in connection with a series of talks which he gave in the West. The talks were under the auspices of the Oil Industry Information Committee. Included in the list of places where he talked were Denver, where he gave the first talk on June 21, Salt Lake City, Cheyenne, Casper, and Billings.

Dr. Egloff spent several days at Yellowstone National Park before concluding his trip.

Graduate Is Offered Many Study Chances

Opportunities for graduate study in science and engineering are greater than ever before, but so are the temptations that cause college students to end their formal schooling at the bachelor's degree level.

The report comes from Dr. Marion H. Groves, assistant dean of the graduate school at Illinois Institute of Technology, Chicago, who attributed both increases to the critical shortage of scientists and engineers.

He said educational institutions are offering more fellowships and assistantships to induce outstanding students to work towards master and/or doctor's degrees.

Dr. Groves pointed out that the national government, private industry, research organizations, and professional and scientific groups are sponsoring an increasing number of fellowships for graduate study.

The number of graduate fellowships at Illinois Tech has grown from 10 to more than 50 during the last five years, Dr. Groves revealed. The value of these grants has increased greatly during this period, he added.

"It appears that all fellowships for next year will award stipends of $2,000 or more," he explained, comparing the figure to the $1,400 average five years ago.

He said that fellowships allowing full concentration on the academic program last year ranged from $1,750 to $2,150, with an average stipend, including tuition, of $1,990 for the academic year.

He also offered some striking figures showing how the value of assistantships has increased during the past 10 years —more than doubled, in fact.

The assistantships will provide $1,750 during the 1954-55 academic year, compared to $825 a decade ago. Five years ago the figure was $1,275.

Dr. Groves explained that, in addition to the stipends provided during the actual graduate training, there are the incentives of higher starting salaries and more rapid promotions after graduation.

Dr. Groves pointed out that the temptations to forgo further study for an immediate position in industry have never been so great as they are at the present.

Each graduating class, he explained, is confronted by the numerous representatives of companies who come to the campus and offer the graduates record-breaking starting salaries.

"The pressure to become economically independent is so great and the lure of lucrative employment so enticing as to be, all too frequently, irresistible to the new graduate," Dr. Groves commented.

Obituaries

The Western Society of Engineers has recently been notified of the following deaths:

* * *

L. B. Mann, who first joined the Western Society of Engineers in October, 1944, died on March 27, 1954. He had been a partner in the firm of Mann, Brown and Hansmann, in Chicago. In the Western Society he had been interested in the work of the Library Committee.

* * *

Edith C. Liewehr, who had been assistant to the executive vice-president of the S. N. Nielsen Company, died on April 26, 1954. She had been a member of the Western Society since September, 1950. She had been interested in the Bridge and Structural Engineering Section, the Hydraulic, Sanitary, and Municipal Engineering Section, and the Women's Council.

* * *

Charles H. MacDowell, a life member of the Western Society since May, 1949, and a member since December, 1919, died on March 14, 1954. Although retired at the time of his death, he had been active in the chemical engineering field. Of recent years he had made his home at Winter Park, Florida.

* * *

J. L. Zachary, a member of the Western Society since 1947, died on January 7, 1954, the Society has learned. He had been staff assistant of the Education and Training division of Commonwealth Edison Company. At the time of his death he was a resident of Maywood, Illinois.

* * *

Martin F. Carlson, a member of the Western Society since March, 1936, died on May 26, 1954. He had been manual traffic engineer for the Illinois Bell Telephone Company, and in the Western Society, had been interested in the Communications Section. He was a resident of River Forest, Illinois.

* * *

Harry Scaar, president of the Scaar Iron Works, Inc., died on June 1, 1954. He had been a member of the Western Society since June, 1948. Mr. Scaar had been interested in Bridge and Structural Engineering Section of the Society.

Transistor Testing Is Faster, More Accurate

Faster and more accurate testing of transistors has been made possible by a new instrument developed at Armour Research Foundation of Illinois Institute of Technology, Chicago.

The instrument, called the Transistor Analyzer, is used to measure directly the circuit constants of transistors while they are in operation.

The analyzer is small, lightweight, and portable and can be used to test any type of junction transistor at low frequencies, according to Rame W. Bull, associate electrical engineer at the Foundation.

Transistors tested are used in circuits wherever small size and low power drain is important, such as in hearing aids and field telephones, he pointed out.

Transistor operation is generally described in terms of small-signal T-equivalent-circuit parameters which are the basis for circuit analysis and design, Bull said. The analyzer is unique because it makes direct measurements of these parameters, he added.

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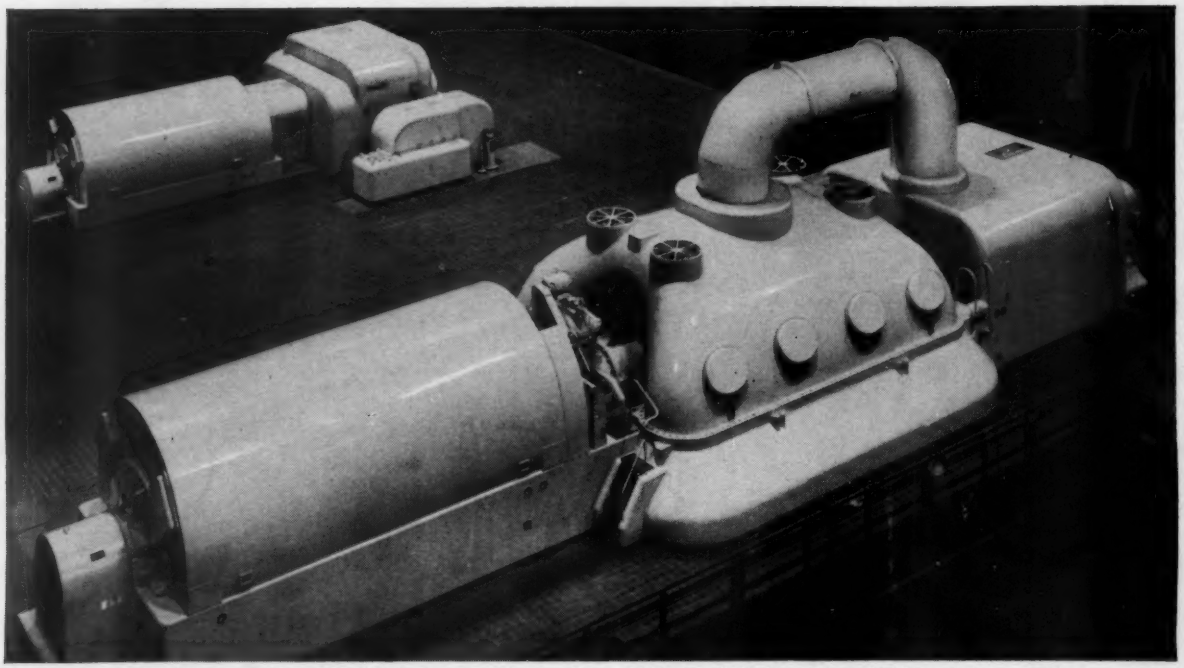

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